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POLYCHAETOUS ANNELIDS FROM PUGET SOUND
AND THE SAN JUAN ARCHIPELAGO, WASHINGTON¹

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In view of pending investigations of the level bottom fauna of the inshore waters of Washington by the Department of Oceanography, polychaetes were studied at the Friday Harbor Laboratories of the University of Washington during the summers of 1961 and 1962. Some species new to the area or new to science are treated here.

FAMILY PHYLLODOCIDAE

Eteonides coineau *difficilis*, new subspecies

Several anterior and posterior fragments, with up to 65 setigers 4.6 mm long were dredged in July 1961 at about 20 m south of Cattle Point, San Juan Island (appr. 48° 25.0' N; 122° 59.0' W) from coarse, not too clean sand. Other specimens were dredged in August 1962 between Reid Rock and Turn Island, near San Juan Island (appr. 48° 32.5' N; 122° 58.5' W), at about 100 m from a coarse, fairly clean sediment mostly made up of broken shells.

Description: The living animal (Fig. 1A) has a very elongated, pseudoannulated prostomium with four antennae of equal length and, on its posterior margin, two eyes. The proboscis is about three times as long as the prostomium and is covered with fairly large, round papillae which are not arranged in rows. The first two segments carry three tentacular cirri and are apparently free from each other, although a separation could not be clearly seen mid-dorsally. The cirrus on the first segment, and the dorsal one on the second segment, are long and slender, whereas the ventral cirrus on the second segment is ovoid and hardly larger than the ventral cirri on the setigers. All tentacular cirri are placed on cirrophores. There are no bristles or aciculae on the second

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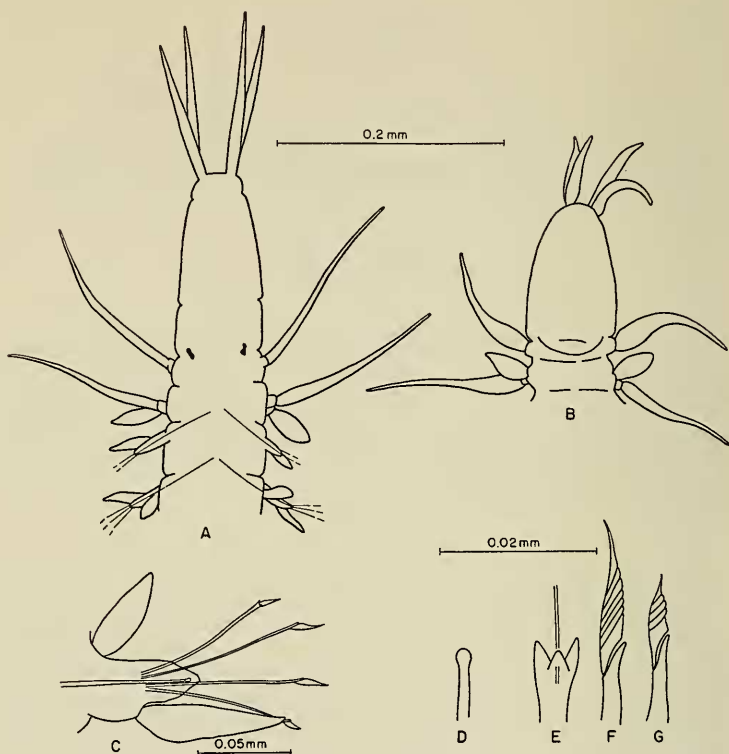


FIG. 1. *Eteonides coineai difficilis*. A, Living animal, dorsal view. B, Preserved specimen, ventral view. C, 10th parapodium. D, Acicula, approximately to scale with setae. E, End of shaft of uppermost seta. F, Median seta. G, Lowermost seta.

segment. There is no dorsal cirrus on the third segment. Thus, the formula of the tentacular cirri is $1 + \frac{O^{ol}}{ol} + \frac{O^o}{aN}$. Hartmann-Schröder (1960) has established the genus *Eteonides* for phyllodocid species with this formula.

The prostomium of the preserved animal (Fig. 1B) is shortened, and of oval shape. The eyes are difficult to make out. The cirrophores of the tentacular cirri are less distinct than in the living animals, and the shape of these cirri is more bulbous than filiform.

The tenth foot is shown in Fig. 1C. The dorsal cirrus which sometimes appears to sit on a small cirrophore, is inserted at the origin of the parapod. In the posterior setigers (60th to 70th) it grows from the very base of the parapod. Also in this region, it does not reach beyond the tip of the foot, in contrast to the ventral cirrus. The ventral cirrus

sits on a moderately distinct cirrophore in the middle and posterior (60th to 70th) setigers. The acicula has a rounded point (Fig. 1D). Anteriorly there are four, posteriorly, five compound setae. The shafts are bifid except the dorsal bristle which is trifold (Fig. 1E); the dorsal bristle usually is slightly thicker than the others. The bristle below it has a very broad blade. The blade of the one or two middle setae is fairly long (Fig. 1F); that of the lowest seta is given in Fig. 1G.

The anal cirri are slender and slightly longer than the tentacular cirri on the first segment.

Living and dead specimens are rather pale. There is little yellow-green pigment on the ventral cirri.

Diagnosis: A subspecies of *Eteonides coineau* Laubier with at least 65 setigers and 4.6 mm length, living on coarse sand in cold water of high salinity. Dorsal cirri shorter than, or equal in length to, parapodia. Uppermost bristle slightly thicker than the others. Tip of the blades of the median bristles long and thin. Yellow-green pigment on the ventral cirri.

Type locality and habitat: San Juan Archipelago, Washington. Because of the strong tidal mixing in the area, the environment on the stations between Reid Rock and Turn Island, and south of Cattle Point, San Juan Island, should be similar. An idea of the prevailing conditions may be obtained from the observations by Phifer and Thompson (1934; see also Herlingvaux and Tully, 1961, with other references) at the Friday Harbor Laboratories. During the year the average monthly means of the surface salinity range from 29.7 to 30.7‰ S, with a deviation from the average for individual months of roughly 0.5‰ either way. The annual range of the temperature values is 7.2 to 10.8° C, also with little variation. At the first station, the salinity of water near the bottom does not drop below 29.0‰, and the oxygen content is not likely to fall much below 50% of saturation.

Types: Holotype—U. S. National Museum Cat. No. 30493. Paratypes—U. S. National Museum Cat. No. 30494.

Discussion: There are four species of *Eteonides* known, *E. elongata* (Southern, 1914), *E. augeneri* (Friedrich, 1937), *E. serrata* Hartmann-Schröder (1960), and *E. coineau* (Laubier, 1961) which, except for *E. serrata*, were described as species of *Pseudomystides*. The first two species have very small dorsal cirri which are inserted on the parapodium itself, whereas in the two other species the cirri are inserted on the base of the parapod. The tips of the bristles of the present material are drawn out more than those of *E. serrata* and *E. coineau coineau* from the type locality. Dr. Laubier kindly sent one of his specimens. In material of *E. coineau* from other Mediterranean localities, the blades of the setae are of similar shape to those in the present material, according to drawings sent by Dr. Hartmann-Schröder. It would be difficult to distinguish the new subspecies from the type subspecies on purely morphological characters. Laubier (1961) stated that the type sub-

species has wine-red and violet pigmentation. The main reason for keeping the present material separate from the Mediterranean form is that it lives on coarse sand in cool water of high salinity. In Europe, *E. elongata* and *E. augeneri*, which are clearly distinct from *E. coineau*, are found in this environment. *E. coineau coineau* has been found in brackish water of high temperature. The new subspecies is distinguished from *E. serrata* by its bristles and by the dorsal cirri which in *E. serrata* reach beyond the tip of the parapodium in the middle region of the body.

FAMILY EUNICIDAE (DORVILLEINAE)

Ophryotrocha vivipara, new species

Two mature specimens of 0.8 and 1.0 mm length were collected by Dr. R. Zimmer in August 1962 from the water standing above a mud sample dredged by him at 22 m in Lopez Sound west of Decatur Island (appr. 48° 30.8' N; 122° 50.7' W). Fig. 2A is based on photographs of the living paratype and sketches of the living holotype.

Description: The prostomium carries a pair of antennae and a pair of palps which are both situated behind a complete ring of cilia. There is no second complete ring of cilia behind the antennae, as in *O. puerilis* Claparède and Metschnikow (1869) but only two pits of cilia (Fig. 2A); ventrally, cilia seem to encircle the mouth but details could not be made out. A pair of eyes is found beneath the border of the first segment.

The first two segments are apodous, each with a complete ring of cilia. There are six setigerous segments. In cross section, the body is almost elliptical; the feet insert below the end of the major axis of the figure. The parapods (Fig. 2B) are without rudiments of dorsal or ventral cirri or lips. In the fourth and fifth parapods, a pointed acicula, two dorsally inserted needle-like capillaries, and two to three compound setae with long blades (Fig. 2C) are found. There are complete rings of cilia on the posterior parts of the setigers. The pygidium is girdled by another ring, and carries an inconspicuous ventral median appendage and two anal cirri. Long stiff hairs are found on palps, tentacles, anal cirri and the distal ends of the parapods (the latter are omitted in the drawings). Short hairs line the front of the prostomium.

The dark brown jaws are visible through the body wall. The mandible of an embryo taken from the type specimen is shown in Fig. 2D. (The broken line indicates its shape in the adults.) Characteristic is the almost straight anterior margin. Fig. 2E and F show the broken forceps and the maxillary apparatus of the paratype pressed under a coverglass; the jaws of the holotype were lost. Looking from above at the forceps (marked by "x") and the apparently very short carrier, one sees a piece with large teeth, above the forceps and presumably free from it; it appears to be less complicated on the left side than on the right side. The caudal end of the carrier of the forceps is widened. Beneath the forceps is a thin piece with many sharp teeth. The left maxillae are shown in Fig. 2E. The right maxillae seem to consist of five strong

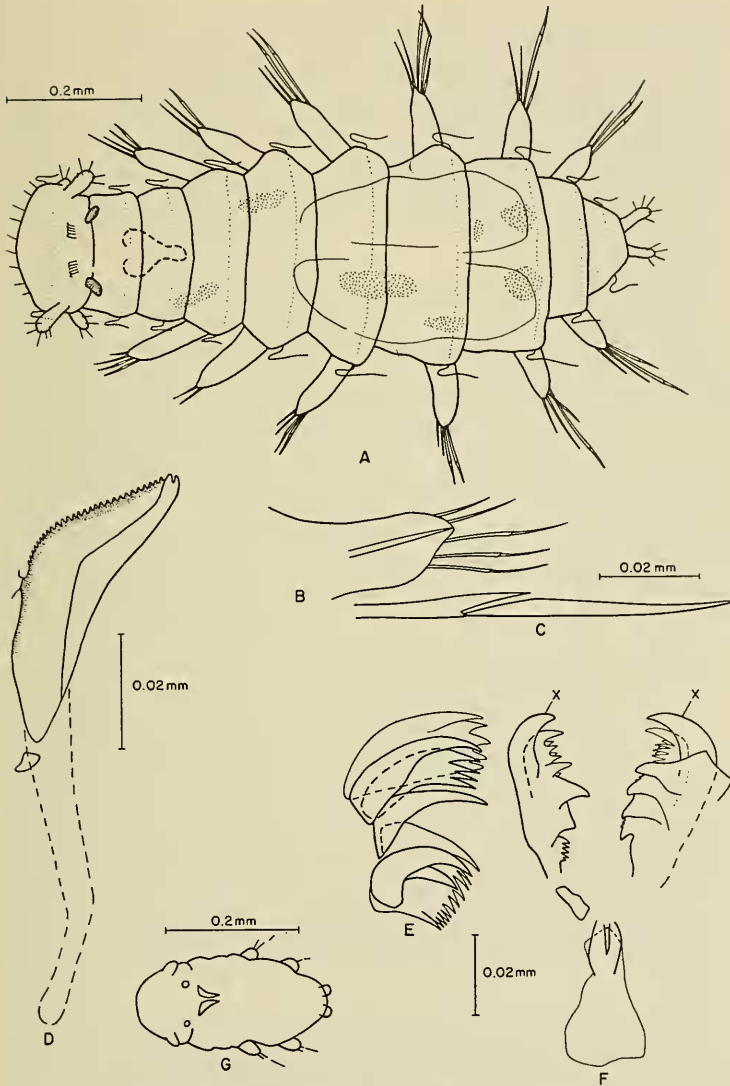


FIG. 2. *Ophryotrocha vivipara*. A, Adult, dorsal view. B, Parapodium. C, Compound seta. D, Mandible of an embryo, the broken line indicating the size in the adults. E, Left maxillary apparatus. F, Forceps, broken. G, Largest embryo taken from the holotype, ventral view.

hooks, that may be separate pieces, and about the same number of thinner plates with many teeth. Maxillary plates with a fairly smooth

anterior margin, as known in *O. puerilis* (Korschelt, 1893; Hartman, 1944), are not present. There is no such forceps in the embryos as is known from young specimens of *O. puerilis* (Korschelt, 1893).

In the paratype, two oval dark masses, presumably the gonads, filled almost the entire space in setigers 3–5, on both sides of the midline (Fig. 2A). In the holotype were found eight embryos in varying states of development, between 200 and 250 μ long. The two oldest were as in Fig. 2C, and had fairly well-developed jaws which could be seen through the mother's body wall; the mandible shows that they were embryos, and not parasites.

The epithelium of the dead animals appears in many places like foam, as observed in living and dead *O. puerilis* by Korschelt (1893). The color of the living adults is pale; the gonads give a pink color to the middle part of the body. Deep red pigment, irregularly distributed in the epidermis, does not fade after one month in formalin (dotted areas in Fig. 2A). The animals swim rapidly by their cilia along the bottom of a dish and up to the water surface. The parapods are seldom used for crawling. The shape of the body changes rapidly from the form shown in Fig. 2A to that of an electric bulb.

Diagnosis: A viviparous species of *Ophryotrocha* of 0.8–1.0 mm length with six setigers. Frontal edge of mandible almost straight, with teeth. Parapods without cirri and distinct lips. Compound setae with long blades.

Type locality and habitat: San Juan Archipelago, Washington. The salinity, temperature and oxygen content at the station must be quite similar to those prevailing near the Friday Harbor Laboratories (p. 199).

Types: Holotype—U. S. National Museum Cat. No. 30491. Paratype—U. S. National Museum Cat. No. 30492. (The jaws are kept on a slide with this same number.)

Discussion: The other known species of the genus (cf. Hartman, 1959) have considerably more segments than *O. vivipara* when mature, and have generally less simplified feet. This new species can be distinguished from young specimens of the others by the straight anterior margin of the mandible, which is toothed. According to Wesenberg-Lund (1938), the margin is fairly straight also in *O. geryonicola* (Esmark, 1878) but in young animals there is a lateral keel not present in *O. vivipara*.

The development of *O. vivipara* differs from that of *O. puerilis* not only in respect to the viviparity, but also because the embryos with four segments bear two pairs of feet. In *O. puerilis* with four segments, no feet (or one pair only) are observed (cf. Korschelt, 1893; Braem, 1893).

It is not yet known whether there are males in the new species, at least temporarily, or whether self-fertilization prevails. *O. puerilis*, one of the few fairly well-known polychaetes (although not well known taxonomically, see below), is a protandric hermaphrodite; Bacci (1951), however, has stated for the Naples population that a few true males

and females do occur. Self-fertilization is rare although not impossible; the offspring develops abnormally (Korschelt, 1895). Normally, the male fertilizes the laid eggs (Korschelt, 1894). The forms described by Huth (1933) as *O. hartmanni* and *O. gracilis* are hermaphroditic throughout their life; self-fertilization usually does not occur (Hartmann and Huth, 1936). These forms have a chromosome number different from *O. puerilis*, behave differently from each other and from *O. puerilis*, and have different ways of developing and depositing their eggs.

Concerning the behavior of *O. puerilis*, it may be mentioned that the author was told by G. E. MacGinitie and N. MacGinitie that the observations reported by them (1949) refer to worms from Newport Bay, near Corona del Mar, Southern California. The authors observed pairing, and brood protection by the male. European observers found brood protection by the female (for Trieste, cf. Korschelt, 1894, 1895) although the male is around for some days before the deposition of the eggs. Hartman (1944), describing North American material, did not find morphological differences justifying the taxonomic separation from the European representatives. According to a personal communication from Dr. O. Hartman, the description was probably based on specimens from La Jolla, Southern California. It may be remembered that the previously lumped populations of *O. puerilis* from Naples and Plymouth do not interbreed successfully (Bacci and La Greca, 1953) and are now regarded as different subspecies. Thus, a new study of the Pacific *O. puerilis* may be worthwhile.

FAMILY SPIONIDAE

Rhynchospio arenincola Hartman, 1936

Syn.: *Rhynchospio* (cf. *arenincola*) Wieser, 1959, p. 105

Many large specimens were collected in August 1962 in the outermost part of False Bay, San Juan Island (appr. 48° 28.9' N; 123° 04.3' W) on medium to fine, fairly clean sand at about -2 ft tide level. This level is exposed on a very few days during low spring tides which do not occur every month. Wieser (1959), however, found the species at +2 to +3 ft. With the prevailing tides of the mixed type, this means many hours of exposure. There is very little freshwater discharge into False Bay.

In the preserved material, the frontal horns point obliquely forward as mentioned by Chlebovitsch (1959) for his *R. arenincola asiatica*. The anterior pair of eyes is, in five or six of the nine specimens studied, larger than the posterior one, and in three specimens equal in size. In the type (Hartman, 1936), the posterior eyes were the larger ones; the subspecies *R. arenincola asiatica* is distinguished from the type by its larger anterior eyes. It seems doubtful that this character is a valid one.

Chlebovitsch (1959) has pointed out that the known species of the genus are distinguished from each other mostly by the shape of the anal cirri. In the present material, a young individual of 30 setigers has only

six conical cirri, instead of the eight in adults. Two insert dorsally and are about $1\frac{1}{2}$ times as long as the ventral ones; there is a fifth cirrus about as long as the ventral cirri and a sixth just budding. A specimen with 64 setigers, of 14 mm length, has one conical cirrus along with filiform cirri of about 0.2 mm length. Chlebovitch recorded very thin cirri whereas Hartman (1936) described conical cirri for the holotype.

Dr. O. Hartman kindly sent the animals collected by Wieser (1959), which are all small. The anal cirri are also filiform. The specimens seem to be identical with those from the new collection.

FAMILY CIRRATULIDAE

Cossura longocirrata Webster and Benedict, 1887

One complete specimen with 45 setigers and almost 3 mm length, and an anterior fragment of a presumably older individual, have been found in a dredge haul by Dr. E. Kozloff in August 1962, on mud bottom at 15 m in Massacre Bay, West Sound, Orcas Island (appr. 48° 38' N; 122° 59' W).

Berkeley and Berkeley (1956) have reported only one achaetous segment (the buccal segment) in material from East Sound, Orcas Island, as has been observed elsewhere. In both the present specimens, there are two achaetous segments following the prostomium, as in the specimens of Webster and Benedict (1887), indicating variability of this character. The tentacle inserts at the posterior border of the second setiger.

The station in West Sound is situated behind a sill. Although the pycnocline usually is shallow, as in East Sound, the temperature at the sampling depth may occasionally reach at least 15° C during summer. The salinity is not much lower than outside (see conditions near the Friday Harbor Laboratories, p. 199) but the oxygen saturation of the bottom water possibly could be low during summer.

FAMILY SABELLIDAE

Laonome kroyeri Malmgren, 1866

Several specimens, up to 25 mm long, were dredged by Dr. E. Kozloff in August 1962 in Massacre Bay, West Sound, Orcas Island (appr. 48° 38' N; 122° 59' W) from mud bottom in 15 m depth (for the environmental conditions, refer to the preceding species).

In a large specimen, there are seven to eight pairs of radioli, without eyes or dorsal appendages, or a palmar membrane. The collar is formed as figured by Malmgren (1866) with a broad dorsal gap and a pair of large, elongated, pointed ventral lobes. There are limbate and spatulate bristles in the thoracic notopodia. The thoracic tori are short and contain only hooks (Figs. 3A and B).

The thoracic uncini are quite similar to those figured by Malmgren (1866) and McIntosh (1922). Fauvel (1927) and Uschakov (1955) have used a figure of Hofsommer (1913) which is very different from

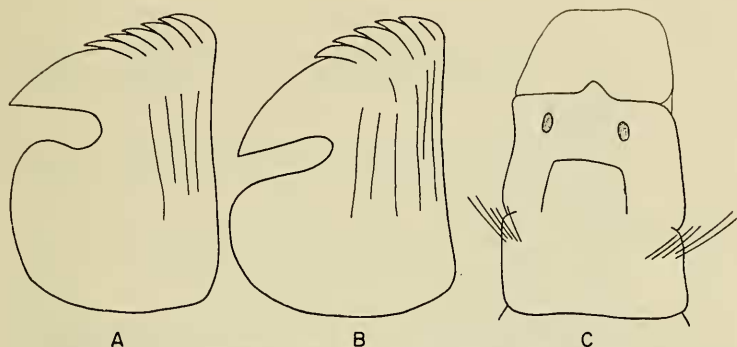


FIG. 3. A and B, *Laonome kroyeri* from West Sound, thoracic uncini from dorsal or youngest part (A) and from ventral or oldest part (B) of torus. C, *Fabricia sabella oregonica*, dorsal view of front end, tentacular crown removed.

either one. Prof. Siewing kindly checked the sample O. X. from the Bay of Kiel which Hofsommer apparently had used. The uncini were found to be fairly similar to those in Fig. 3 (see also Evenkamp, 1931, for other material from Kiel).

Previously known in the Pacific from the area near Kamchatka and from the Sea of Japan (Uschakov, 1955).

Fabricia sabella (Ehrenberg) subsp. *oregonica* Banse, 1956

Many specimens were collected by Mr. M. G. Hatfield in August 1962 in the high intertidal zone in False Bay, San Juan Island (appr. 48° 29' N; 123° 04' W). The animals were taken in felt-like mats of algae which can become lukewarm from the sun during low tide.

The specimens agree with the subspecies described from material collected in Coos Bay, Oregon, in their subspatulate thoracic notosetae which have a very long tip and differ little in shape and length from the other notosetae. The number of thoracic hooks reaches 14 only in one out of four animals checked, the specimens being not more than 2 mm long. This high number was thought to be characteristic of the subspecies. In the other individuals, there were only eight to nine hooks in the thoracic neuropods.

Additions to the original description: The tentacular crown makes up $\frac{1}{6}$ to $\frac{1}{4}$ of the total length. The radioli bear 3 to 5 pairs of pinnulae ending at the same level. The collar (Fig. 3C) is broader than in the type subspecies, and occupies $\frac{1}{3}$ of the circumference of the prostomium. The blood is bright green.

It is unknown whether the previous record of *Fabricia sabella* from neighboring areas (Berkeley, 1930 *partim*, see Banse, 1956) refers to this subspecies. The original material is lost (personal communication from Dr. C. Berkeley). The collar of the present specimens is considerably broader than shown in Fig. 1C of Berkeley.

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